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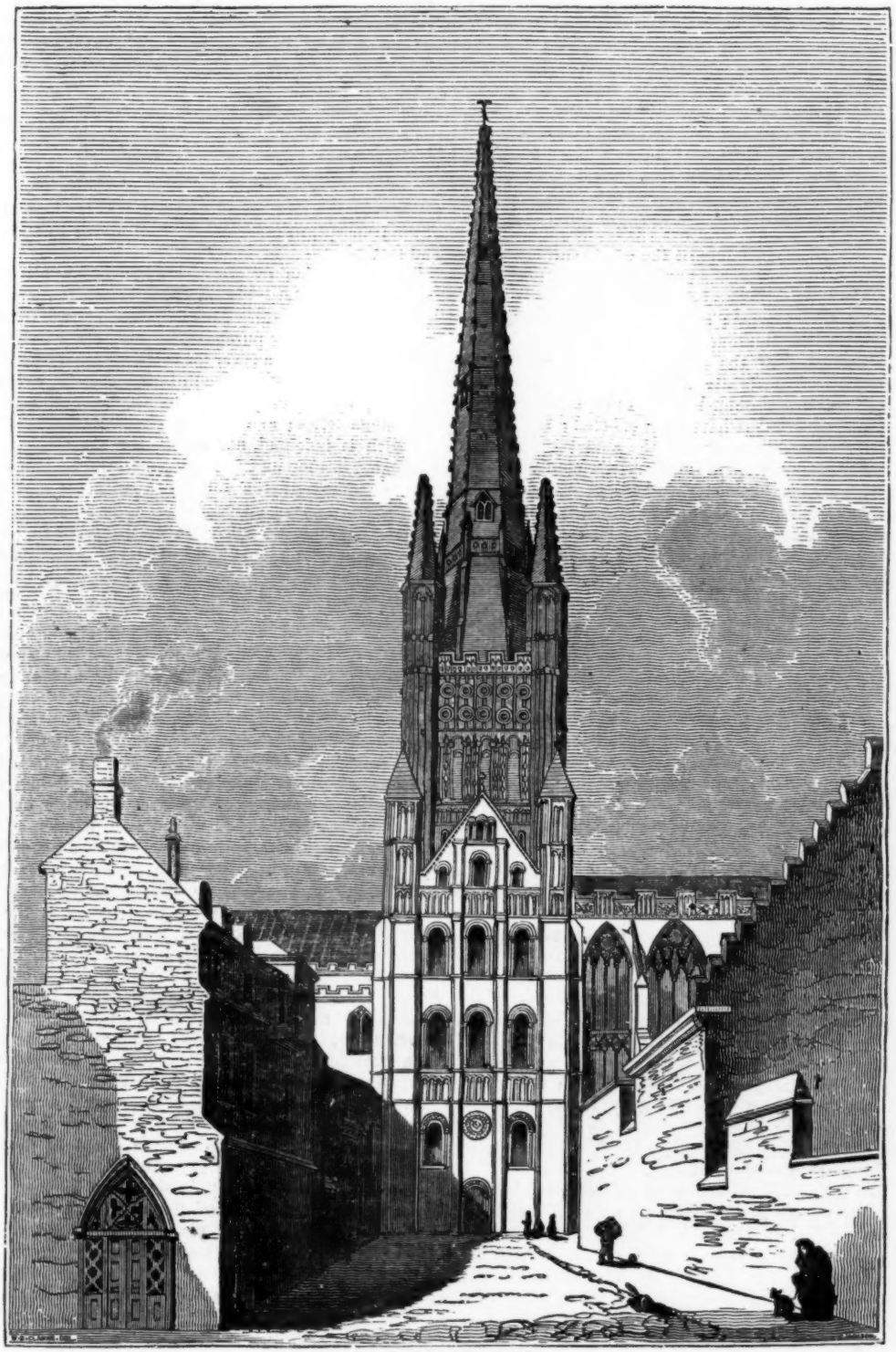
NORWICH CATHEDRAL.



[Cathedral of Norwich.]

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Norwich Cathedral, though not to be classed amongst the most beautiful or remarkable of our ancient ecclesiastical structures, yet has much to interest the curious and the lover of antiquity. It is still a noble pile: and although accident and violence have contributed nearly as much to its decay as the influence of time, and the crumbling and friable nature of the stone of which it was originally constructed has given it an appearance of extreme dilapidation, it possesses in its decay that air of solemn grandeur which is so peculiarly characteristic of our old cathedral edifices. "As an object of architectural antiquity," says Mr. Britton, "the cathedral church of Norwich is peculiarly interesting; for it comprises, in its different members, many curious specimens of the Norman style of design, and some forms and features of unique character. Compared with many other cathedrals, it is, however, small in size and meagre in embellishment. Its transepts are narrow; the aisles of the nave are small and low; the east end and north side, externally, in a dilapidated and ragged condition; almost the whole surface of the building presents a ruinous appearance: the north side of the nave is obscured and darkened by a mass of trees n the bishop's garden; some houses are attached to and obscure the building at the south-west end; and at the east side of the south transept are other incongruous and unsightly appendages." Since Mr. Britton's work was published, in 1817, some improvements and renovations have been effected: but the evil (that of the friable nature of the stone) is a primary one. "Had our ancient architects," continues Mr. Britton, "studied chemistry, and the natural history of rocks, with as much care and zeal as they did church-architecture, they would have been more choice in the selection of stone, and we should not have so frequently cause to deplore the destructive effects of weather on their scientific and curious works."

It has been supposed that the original building was of wood, and that therefore the present structure is the second erection on the site of the cathedral. The original edifice was nearly destroyed about 200 years after its foundation: but the extreme antiquity of portions of the present building discredits the supposition of an entire destruction; and it is concluded that the original church was at least partly constructed of stone, and that a portion of it enters into the composition of the present cathedral.

In giving a brief account of this cathedral, we shall first extract a general description from Mr. Britton's valuable work on 'Cathedral Antiquities.' "The whole church now consists of a nave, with two lateral aisles; a north and south transept, without aisles or columns; a choir, occupying part of the nave and area under the tower; an unoccupied space east of the choir; and a chancel, with side aisles, continued round the semicircular east end:—a chapel of two compartments, and of very singular form, at the south-east angle of the church; and a corresponding chapel at the north-east end; a square chapel, branching from the south side of the choir; a small chapel, with semicircular east end, on the east side of the north transept; a tower and spire, rising from the intersection of the transept with the choir and nave; and a cloister, nearly perfect, on the south side of the church.

"In the semicircular or altar end of the church, as viewed from the choir, there is an union of solidity and elegance which cannot fail to delight the spectator; and he will view the lantern under the tower with pleasure. The whole of the vaulting of the church is finely executed; and the bosses, at the intersection of the ribs, contain a vast variety of curious sculpture. The nave presents an interesting series of semicircular arches, with corresponding piers, columns, and ornaments; and, although narrow and long in its proportions, it is impressive and grand. In the cloister, the antiquary and general observer will find much to excite curiosity and admiration. The lavatories, doorways, windows, and buttresses, with their clustered columns, are all entitled to critical examination, and will amply repay a diligent study by the gratification they must afford. The Erpingham Gatehouse, however, is the most elegant and most curious architectural object connected with the church: unique in origin, form, decoration, and condition, it commands the admiration of all classes of visitors. At the south-west corner of the close is another ancient gatehouse entitled to notice; and in the bishop's garden is a third old gateway, and an insulated fragment of the ancient palace."

The height of the spire is 315 feet;—only one spire in Britain, that of Salisbury, having a greater elevation. The two western towers, usually attached to our cathedrals, are wanting in this of Norwich. The extreme length of the building is 414 feet. The extent of the transept, or cross-aisles, from north to south, is 180 feet

The foundation of Norwich Cathedral is attributed to Herbert de Lozingia, in 1096, in the tenth year of William II. The story runs that, having acquired the see of Thetford by purchase, he was cited to appear before the pope, to answer for this and other simoniacal practcies. He was deprived of his bishopric, and commanded, by way of penance, to build certain churches and monasteries; and to this circumstance, it seems, Norwich is indebted, not merely for the origin of its cathedral, but for its advancement to the rank of a city, and for many of the numerous religious structures for which it has been celebrated from an early period. There must have been some arrangement or mutual understanding in this affair: for though Lozingia was deprived of the bishopric of Thetford, he had yet the power or liberty of transferring the see to Norwich, of which he was solemnly consecrated the first bishop by the Archbishop of York. The cathedral continued, as was the case with most of our ecclesiastical structures, to be added to by successive prelates, and at length became a structure of considerable magnitude.

In the year 1272, however, a furious insurrection of the people of Norwich occurred, in which the cathedral was so totally defaced as to have given rise to the conjecture, previously adverted to, that the original structure was of wood. The insurrection arose out of a long-pending quarrel between the monks and the people. In this tumult, many females took part, one of them having, with her own hand, set fire to the cathedral. The monks do not appear to have been altogether passive spectators of the scene; the prior headed them in the conflict with the people,—many lives were lost on both sides,—and the church, tower, and adjacent buildings were nearly destroyed. The monarch (Henry III.), on hearing of the insurrection, assembled the hierarchy at Eye, in Suffolk, and the citizens of Norwich were subjected to extreme severities. An interdict was laid upon the town;—sentence of excommunication was passed upon all concerned in the riots;—thirty-six individuals were condemned to be dragged about the streets by horses until they were dashed to pieces;—females were burnt to death and hanged;—nor was the interdict taken off until the citizens consented to pay, in six years, 3000 marks towards the re-edifying of the cathedral, besides 100 pounds in money for a pix, or cup of gold, weighing ten pounds. The arrogance of the monks, which appears to have been the exciting cause of the insurrection, escaped without censure, with the single exception of a short imprisonment endured by the prior.

The cathedral was restored in 1278; the king, queen, and many of the nobles contributing to its re-erection, in addition to the sum exacted from the

citizens. During the wars between Charles I. and the Parliament, the misjudging violence of the Puritans subjected the cathedral to considerable injury. The sculpture, carving, organ, and other parts, were either destroyed or defaced, and almost every brass in the church taken away. Soon after the Restoration, the loss of these things was partially supplied. In June, 1801, a fire broke out at the west-end of the roof, when a great deal of the timber-work was consumed, the lead melted, and the whole fabric in imminent danger. The flames were, however, successfully checked.

Since the commencement of the present century the interior has been repeatedly repaired, and, as Mr. Britton satirically remarks, "beautified;" and various improvements and renovations have of late years been applied. Although there are a few not uninteresting circumstances relative to the monuments and individuals connected with the cathedral, our limits will not permit us to describe them.

ARTESIAN WELLS.

Artesian Wells are formed by perforating the earth with a set of instruments called "boring rods," until a subterranean body of water be reached whose sources are higher than the spot where this operation takes place. The effort which water makes to reach its own level in this instance causes it to ascend above the surface; and thus an abundant supply of this necessary element may be obtained in districts which otherwise might be without so great a blessing. The Romans often went to an incredible expense in obtaining a proper supply of water; and the remains which still exist of their aqueducts are amongst the noblest monuments of their genius and enterprise. Works of this description, however, could not be constructed without an immense expenditure of labour and capital; and it is clear that an application of the principles of hydraulics and geological science would have been a much more simple and economical mode of proceeding. The Turks have availed themselves of the simple fact of the tendency of water to find its level in executing works as efficacious as the Roman aqueducts, but a thousand times less expensive. Their *Souterazi* are water-courses of brick-work, carried from a reservoir on some eminence down one hill, along the surface of a valley, and up the opposite hill.

It is easy to understand the cause which occasions the water of Artesian wells to ascend to the surface; and the following explanation may serve to show the circumstances under which this principle is usually brought into action. If the rain which falls, or the snow which is melted, on opposite ranges of mountains, filtrates through porous strata, or finds its way through apertures or fissures of stone, situated between strata either quite or almost impervious to water, and running below the surface of the valley, it makes for itself a channel, the form of which we will suppose to be that of an elongated curve. If any part of the valley be bored until this pipe or water-course be reached by the boring-rod, the water will spring up, under the impulsion of the law of hydraulics to which we have alluded, and a natural fountain will by this means be created. This result will not be affected by the extent of the valley, which may be a mile in width or a dozen miles. The force with which the water ascends will of course be regulated by the position chosen for the operation. It will be the greatest at that point which is situated at the lowest level, and will diminish as the source is approached from whence the supply is derived. The small springs which are met with in sinking a well are regulated by the same laws as Artesian fountains, but their sources are not sufficiently copious to enable them to reach the surface.

The term Artesian is derived from the name (*Artois*) of one of the provinces into which France was formerly divided. In this district it often happens that the only way of obtaining water is by boring. In the number of the 'Annuaire,' published by the French Board of Longitude, for the present year, there is an article, by M. Arago, which contains a number of facts relating to Artesian wells, from which we borrow such as are best calculated to explain their most important phenomena.

The question as to whence Artesian wells derive their supplies is one of the most interesting connected with the subject. The vapours of the atmosphere form one of their sources. A few hours after heavy rains, the miners of Cornwall observe a considerable augmentation in the water contained in some of their deepest pits. The fountain of Nîmes, in France, throws out, when lowest, about 280 gallons per minute; but if heavy rain falls in the north-west, although at a distance of seven or eight miles, its volume is increased to upwards of 2000 gallons. The temperature, however, is scarcely changed by this great additional quantity; thus proving that it passes with great rapidity by channels situated very deeply below the surface.

The fountain of Vaucluse, likewise in the south of France, if it received all the rain which fell during the whole year, on an extent of thirty square leagues, would not obtain a supply adequate to the yearly issue which it pours forth. When it rises from its subterranean bed, it in reality forms a river; and the volume of its waters when at its lowest is estimated at 480 square yards per minute, which at times is swelled to 1494 square yards. Its mean volume is 962 square yards. This fountain, it is clear, must obtain its waters from some more abundant source than the percolation of rain-water through the pores and fissures of the earth. Its reservoirs, also, must be capable of containing a great mass of fluid, and the channels by which it flows must be large enough to contain a subterranean river.

These reservoirs and these channels are created by fractures in great areas of stratified rock, occasioned by the action of a mighty power, which, at some period, has broken them in various directions. In some cases, these cavities actually withdraw from the surface considerable rivers. The Guadiana loses itself in a flat country, in the midst of a vast prairie: and when a Spaniard hears an Englishman or a Frenchman speaking of the bridges of their respective countries, he will tell them that there is one in Estremadura on which 100,000 cattle can graze. The Meuse and several other rivers in France also disappear in the same manner; some being sucked in by apertures in their bed, situated at various distances along the course of the stream. In the Austrian dominions, the river Poick pursues its course in the cavern of Adelsberg, where its waters lose themselves and re-appear several times. This cavern has been penetrated for the space of two leagues from its entrance, at which point a lake presents itself which has not yet been crossed. Humboldt mentions a cavern in South America, about 25 yards high, and 27 or 28 broad, which the traveller can penetrate for 800 yards, into whose recesses are rolled the waters of a stream above 10 yards wide. The grotto of Windborg, in Saxony, is also a remarkable instance of the extent of the earth's internal communications, being connected with the cavern of Cresfield, from which it is some leagues distant

The Artesian fountain at Tours recently presented some phenomena proving the existence of an extensive and complete line of subterranean communication. In January, 1831, the vertical tube by which the waters of this fountain ascended was shortened a little more than four yards, on which its volume was immediately aug-

mented a third; but this sudden increase rendered the water less clear than usual. During many hours there were brought to the surface, from a depth of above 110 yards, various substances, among which were recognised twigs of hawthorn, several inches in length, blackened by their long stay in the water,—stalks and roots of marshy plants,—and seeds of various kinds, in a state which showed that they had been in the water since the harvest, and, consequently, that about four months had been spent in performing their hidden voyage. Shells, and other deposits which a small river, or stream of fresh water, leaves when it overflows its banks, were also brought up during the increased action of the fountain, proving the freedom with which they circulated at the depths below.

An instance is mentioned by M. Arago of one of these subterranean rivers being reached by some workmen who were boring for water close to the Barrière de Fontainebleau, at Paris. As usual, the progress of the work was slow, but, all at once, the boring rod descended nearly eight yards. When they attempted to withdraw it, it was evident that it was suspended in a body of water whose current was so strong as to occasion the instrument to oscillate in a particular direction. We have before stated that the course which water took in order to find its own level might be of any length; a fact which is clearly proved by the circumstance of the crew of an English ship becalmed in the Indian seas discovering fresh water rising from the depths of the ocean to the surface. The nearest point of land was 100 miles distant, and from hence it had come by a channel situated below the bed of the sea.

These various facts will account for the phenomena connected with Artesian fountains: but the periodical disappearance of the waters of the lake of Zirknitz, in Carniola, illustrates one of these in a manner so clear and distinct that we cannot omit noticing it. This lake is about five miles long and two and a-half broad. Towards the middle of the summer, if the season be dry, its level rapidly sinks, and, in a few weeks, it becomes dry. The apertures by which the waters have retired may be then distinctly perceived; some being perpendicular, and others in a lateral direction towards the caverns of the neighbouring mountains. Immediately after the waters have completely disappeared, the whole extent of the surface which they covered is put into cultivation; and, at the end of a couple of months, the peasants reap an abundant harvest of rye, millet, and grass. Towards the close of autumn, the waters return by the same natural channels by which they had disappeared. It frequently happens that a heavy shower of rain on the mountains of Zirknitz will occasion the lake to overflow its banks.

The temperature of Artesian springs is invariably higher in proportion as their depth increases. The deepest of which we have seen any statement is near Dieppe, and is about 340 yards below the surface. A well formed near Perpignan produces about 425 gallons per minute; and one at Tours ascends more than two yards above the surface, and gives 234 gallons per minute.

In France, the waters of Artesian springs are sometimes made the moving power in corn-mills. At Frontès, near Aire, the waters of ten Artesian springs put in motion the wheels of a large mill, and act besides upon the bellows and forge-hammer of a nail-manufactory. At Tours, a well of nearly 150 yards in depth pours 225 gallons per minute into the troughs of a wheel seven yards in diameter, which is the moving power of an extensive silk-manufactory. Besides their general utility in irrigations, and for purposes of domestic comfort and salubrity, the water of Artesian springs has been specially applied with advantage for other useful objects. The workshops of M. Bruckmarm, in Würtemburg, are warmed by means of water conveyed in pipes from an Artesian spring, the temperature of whose source is considerably higher than that of the atmosphere. M. Arago also states that there are greenhouses whose temperature is kept up by means of the circulation of a constant volume of Artesian waters. At Erfurt, they are used in the formation of artificial beds of cress, which produce 12,000*l.* a-year. In the north of France, the reservoirs in which the flax is steeped which is destined to be employed in the manufacture of lace and the finer descriptions of linen are supplied by Artesian springs, whose waters, being remarkably clear and of an equable temperature, dissolve the vegetable matter with the least injury to the most valuable properties of the plant. In fish-preserves it is often found that the fish are killed both by the severity of the winter and the excessive heats of summer; but this effect of the inequality of the seasons has been prevented at the fish-ponds of Montmorency, near Paris, by furnishing them abundantly with Artesian waters.

Mode of Trading at Shendy.—The wholesale trade at Shendy is principally conducted through the agency of brokers. A caravan no sooner arrives than every merchant's house is crowded with brokers; but the avidity and parsimony of all parties are too great to allow them to bring their transactions to a speedy conclusion. Even after the bargain is made, each party endeavours to cheat the other before the goods are delivered and the money paid. In addition to this, every attempt to enter into an engagement of any importance becomes known all over the place and the jealousy of the traders often prevents its taking place. No merchandise has its fixed price: there is no such thing as a price-current; every one sells according to the prospect he has of cheating the buyer and bribing the broker. The purchase-money, or, in case of barter, its equivalent in merchandise, is almost always immediately paid down. The longest credit I have witnessed is a couple of days; and it is evident, on the termination of every commercial transaction, that the buyer and seller reciprocally entertain suspicions of each other's honesty. To oblige a debtor to settle his accounts, recourse is generally had to the slaves of the Mek, who act as police-officers; but a man who is unprotected and without friends is sure to lose the greater part of his goods if he allows them to go out of his hands without immediate payment.—*Burckhardt's Travels in Nubia*, p. 298.

Imitative powers of the Chinese.—The people discover no want of genius to conceive, nor of dexterity to execute; and their imitative powers have always been acknowledged to be very great. Of the truth of this remark we had several instances at Yuen-min-yuen. The complicated glass lustres, consisting of several hundred pieces, were taken down, piece by piece, in the course of half an hour, by two Chinese, who had never seen anything of the kind before, and were put up again by them with equal facility; yet Mr. Parker thought it necessary for our mechanics to attend at his warehouse several times, to see them taken down and again put up together, in order to be able to manage the business on their arrival in China. A Chinese undertook to cut a slip of glass from a large curved piece, intended to cover the great dome of the planetarium, after our artificers had broken three similar pieces in attempting to cut them with the help of a diamond. It is well known that a Chinese in Canton, on being shown an European watch, undertook and succeeded to make one like it, though he had never seen anything of the kind before; but it was necessary to furnish him with a mainspring, which he could not make: and they now fabricate, in Canton, as well as in London, and at one-third of the expense, all those ingenious pieces of mechanism which at one time were sent to China in such vast quantities from the repositories of Cope and Merlin.—*Barrow's Travels in China.*

HACKFALL.

[Alum Spring at Hackfall, Yorkshire.]

HACKFALL is situated about seven miles north-west of Ripon in Yorkshire. The name is supposed to be derived from "hag," a witch, and "fall," a descent; the compound signifying "the witch's valley;" and indeed there is no situation which old superstitions might have been more likely to mark out as a fitting abode for unearthly beings than this deep, gloomy, and sequestered vale. Others, however, think that the name is probably a corruption of *Ac-fell*, Acorn-hill, which it might be fitly named from its rich plantations of oak. It is worthy of remark that the beauties of this romantic spot lie within so circumscribed a district, that to a traveller on the road, or a peasant in the adjoining fields, their existence would probably be quite unsuspected; nor is there any thing in the tame character of the surrounding country which could lead the lover of the picturesque to look for that exquisite combination of natural effects, tempered and improved by art, which Hackfall offers.

The entrance into the grounds is pleasant, but not very striking. A little rivulet, rising at some distance, runs into a deep woody glen, and forms three or four

small pools, on issuing from which it makes as many cascades, judiciously varied in their forms. It then flows with precipitancy to the river Ure, at the bottom of the dell, rushing over rocks and heaps of stone which obstruct its passage, and making a number of waterfalls more or less full and rapid. At a short distance from the second gate two springs issue from the rock and fall gently down its side. A little further down the visitor comes to a hill, from whence the water springs and forms a double cascade, which, after rushing over rocks and beds of stone, joins the rivulet below. Still further on there is another spring, somewhat less than the former: and, after passing a hill crowned by an artificial ruin, a winding walk, under a shade of lofty trees growing on a steep bank, conducts the spectator to Fisher's Hall,—a small octagon room built of petrified substances formed by several springs in the ground, and surrounded by hanging wood. At this spot two cascades are divided by a grove of fine trees. That on the left impetuously forces its way over a slaty rock, overhung with the spreading branches of the adjoining wood: the other falls down an irregular bed of rocks, but not in such strong breaks as the former. Without minutely detailing the successive cascades, and other objects and points of view which intervene, it may suffice to mention that an arrangement of the most interesting walks, through landscapes that cannot be excelled in variety and picturesque effect, lead to several romantic situations in pleasing succession, and at length to the summit of a rock called Mowbray Point, a commanding eminence, from which the most grand and extensive prospects are obtained. Mr. Gilpin says, that he scarcely remembers to have anywhere seen an extensive view so full of beauties and so free from faults. In the immediate vicinity, variegated valley, the river confined between its rocky banks, and bordered by impending hills and woody summits, with a number of villages and farms, compose a beautiful assemblage. The distant objects also form a prospect which may be ranked among the finest in England. In the front are the whole range of the Hambleton Hills and the town of Thirske, with an extensive and fertile country intervening: towards the right are Gilling and Craike Castle, the Cathedral of York, at the distance of thirty miles, and the Wolds in the East Riding, forming the boundaries of the view; while, towards the left, the mountain called Roseberry Topping is distinctly seen at the distance of forty-five miles, and the prospect terminates among the rugged heights of the eastern moors.

The spring represented in our wood-cut is impregnated with alum, which abounds in the strata of the adjacent district, and is worked to a considerable extent in the neighbourhood of Whitby, Guisborough, &c. Alum works were established at Whitby about the year 1600, and, with those since established near Glasgow, still supply the market with a large quantity of this article. At Whitby it is prepared from alum-slate, the stratum of which is about twenty-eight miles in length. The cliffs are in general precipitous, and are from 100 to 750 feet in height. The slate is of a bluish grey colour, and varies considerably in hardness. At the top of the cliff it is so soft as to be crumbled between the fingers, whilst at the bottom it is as hard as roofing slate. This slate has never been accurately analyzed; but it does not appear to contain potash-salts, which are therefore added. The method used at Whitby in obtaining the alum, is to mix the broken alum-slate with fuel and set it on fire. When the slate has been sufficiently calcined, it is dissolved in water. To the solution potash-salts are added, and the crystals of alum are formed in it. It takes 130 tons of calcined slate to produce one ton of alum. In other places the processes are different in detail, but they are mostly the same in principle.

These alum-mines were discovered by Sir Thomas Chaloner, through or near whose estate, near Guisborough, part of the stratum extended. This gentleman when in Italy spent some time at Puteoli, where he had occasion to observe the process of making alum at Solfatara, and to know the profits it produced. He noticed that the people collected near that place a kind of saltish flour or dust, that covered the surface in the summer time, and threw it into large vessels full of water. These vessels being set in the earth over certain natural vents in the mountain, the water was evaporated by the warm effluvia, and the alum left behind. Sir Thomas (then Mr.) Chaloner was an accurate observer, and his subsequent discovery in England indicates with how much attention he had noticed the character of the soil, and its effects upon the vegetables produced in the neighbourhood, although he could not at that time have had any particular interest in the subject. This is shown in the details which Camden has furnished on the subject in the 'Britannia.' Speaking of Guisborough, he says:—"The place is really very fine, and may, for pleasantness, a curious variety, and the natural advantages of it, compare with Puteoli in Italy; and then, for a healthful and agreeable situation, it certainly far surpasses it. The coldness of the air which the sea occasions is qualified and broken by the hills between. The soil is fruitful, and produces grass and fine flowers a great part of the year. It richly abounds with veins of metal, and alum-earth of several colours, from which they now begin to extract the best sort of alum and copperas in great plenty. This was first discovered a few years since by the admirable sagacity of that learned naturalist Sir Thomas Chaloner, knight, by observing that the leaves of trees were of a more weakly sort of green here than in other places; that the oaks shot forth their roots very broad, but not deep, and that these had much strength, but little sap in them; that the soil was a white clay speckled with several colours, namely, white, yellowish, and blue; that it never froze, and that upon a pretty clear night it shined and sparkled like glass upon the road-side."

The time when this discovery was made seems to have been about 1600, or perhaps a little earlier. Much labour was bestowed, and great expense incurred, before the alum could be obtained; which was probably owing to the climate, and to the variation in the process which this rendered necessary. The difficulties of detail were, however, finally overcome by the assistance of Lambert Russel, and two other workmen employed in this business at Rochelle in France, who were privately brought over to this country. No sooner, however, did the works begin to return a little profit to the proprietors than it was adjudged to be a royal mine, and so came into the hands of the crown. It was then granted to Sir Paul Pindar, who was to pay a rent of 15,000*l.* a year. At that time 800 persons were employed on the works. Notwithstanding the high rent, the farm of the mines produced a large profit to Sir Paul, who kept up the price of the article to 26*l.* a ton. But the Long Parliament voted the affair a monopoly, and restored the mines to the original owners. At the Restoration not less than five works were carried on at different parts of the stratum, and the competition between the different proprietors soon brought the price of the commodity down to 13*l.* a ton. In the end, the mine which had been opened near Whitby profited so much by the advantage of its situation, that the original works near Guisborough soon fell into disuse; but it does not seem that a less quantity of alum is now derived from this stratum than at any former period.

The particulars concerning Hackfall in the above account are chiefly derived from the 'History of Ripon,' the 'Beauties of England and Wales,' and the 'Gen-

tleman's Magazine.' The facts concerning the alum stratum, and the manufacture, are from the article ALUM in the 'Penny Cyclopædia;' and the rest is from the notes to the memoir of Sir Thomas Chaloner in the 'Biographia Britannica.'

HUMMING-BIRDS.

THE geographical distribution of birds would scarcely seem to a cursory observer to be regulated by any definite laws. It would rather appear that the localities of the several tribes were quite capriciously assigned, and that the labour of the inquirer could effect no more than the accumulation of disjointed facts, from which no principles could be deduced. This, however, would be a very incorrect view of the case. The subject is, indeed, intricate; and much remains to be investigated, as it is only of late years that the attention of naturalists has been directed to it.

Some families, genera, or even species, are distributed throughout every part of the globe; while others are confined to isolated spots. Some extend within given latitudinal lines throughout the circle of the earth; while others are compensated for a limited latitudinal range by an ample spread between given lines of longitude. Thus, some of the ptarmigans (the willow-ptarmigan, for instance), the snowy owl, the jer-falcon, and many more, are spread through the northern latitudes of Asia, Europe, and America; and the parrot tribe ranges round the globe within given latitudes on either side of the equator,—India, Africa, America, and New Holland, each producing their peculiar species. On the contrary, many tribes are exclusively restricted to an appointed country; and others, that are in general spread over the earth, are denied admission to some peculiar region. Thus, the woodpeckers abound in the Old World and in the New, from north to south, but they are excluded from the continent of Australia. It may, however, be received as a rule (though the inadequacy of our information prevents us from clearly following it out in all cases), that those tribes of birds, whose localities are circumscribed within given limits, will in other countries, where all concomitant circumstances are the same, be represented by tribes filling, as it were, their place, performing their work, and displaying in the main the same habits and manners. We may instance a few of these harmonies. The peacock, of which there are two species, is limited to India and its adjacent islands; but in America its place is supplied by the turkey, of which there are two species also, and in Africa by the guinea-fowl. The ostrich roams the deserts of Africa; the emeu the wilds of Australia; the cassowary the luxuriant islands of the Indian Archipelago; and the rhea the hilly regions of South America. The pheasants of Asia are represented by the curassows and guans in America,—where the *ortyx* takes the place of the quail, and the *tinamoo* that of the bustard. The honey-eaters of the South Sea islands, the brilliant sun-birds of India and Africa, and the still more splendid humming-birds of America, respectively occupy in their own territories each others' place. If these ideas be correct, then it must follow that no group of birds can be studied with advantage in an isolated point of view;—to know them we must know their affinities.

With these preliminary observations, which apply more or less universally, we introduce the beautiful group to which we have last alluded, namely, humming-birds, to the notice of our readers. This group is, in every point of view, most interesting to the naturalist. They are natives of the New World; and rich as that continent is in the most splendid feathered beings, the brilliancy and grace of these small birds are such as to excite the highest admiration in the spectator, who at once acknowledges their pre-eminence. Our knowledge of their habits and economy is, however, very limited at present; nor have their affinities been hitherto fairly investigated.

Recent discoveries have proved that their range of habitation is more extended than was once imagined; for though they chiefly abound in the intertropical latitudes of America, many visit the temperate and colder portions of that continent. The ruby-throated humming-bird (*Trochilus Colubris*), passes north as far as the interior of Canada, migrating like the swallow. Nor is this the only species which extends into a colder climate. Captain King, while on his survey of the southern coasts, met with numerous species flying about in a snow-storm near the Straits of Magellan, and discovered two species (*Trochilus Fernandensis*, and *T. Stokesii*) in the island of Juan Fernandez. Still, however, the central regions of the continent, and the islands adjacent, are their chief resort. There they people the woods and the gardens, glancing in the sun like meteors as they flit by with inconceivable rapidity, or, suspended on their burnished and quivering wings, explore the nectary of some scented blossom. These birds may be almost said to live upon the wing. There is no bird that equals them in power of flight, and they are quick as lightning in their motions. Their wings are of extraordinary length, and this, with their shape and the character of the feathers composing them, contributes to their efficiency. The feet and legs, on the contrary, are small and feeble; they are, in fact, of merely second-rate importance in the economy of the humming-bird. The ground and the trees are not its element. It sometimes, indeed, settles on a twig, while it preens its plumage of glittering scale-like feathers, or arranges the moss and down of its nest; but the air is its abiding place, where it feeds and passes the whole of its active existence. Wilson observes that "the humming-bird is extremely fond of tubular flowers, and I have often stopped with pleasure to observe his manœuvres among the blossoms of the trumpet flower. When arrived before a thicket of those that are full blown, he poises or suspends himself on the wing, for the space of two or three seconds so steadily, that his wings become invisible, or only like a mist, and you can plainly distinguish the pupil of his eye looking round with great quickness and circumspection." With respect, then, to the shape of these powerful organs of flight, we may notice that they are narrow-pointed, and more or less curved inwards, a good deal resembling those of the swift,—and are mainly composed of the primary quill feathers, beautifully graduated, the first or outer one being the longest. The secondary quill feathers are very short, and occupy the inner edge at the base of the primaries, taking up little room, and adding nothing to the breadth of the wing as in birds in general. The structure of these feathers must not be overlooked; they consist of a strong and peculiarly elastic shaft, which in many species is very thick at its commencement. On each side of this shaft is the vane, composed of narrow, closely set, springy plumelets, so compacted together, as to give the idea of a thin metallic or horny web, and which, cutting the air at every stroke, produces that humming noise which is heard, while the bird hovers over the flower, or darts arrow-like along. Of the immense strength of the pectoral muscles by whose action these long pointed wings are thus rapidly agitated, we can scarcely form an adequate conception.

Next to the wings, the tail is the most important agent as an organ of aërial progression. It is not only the rudder by which a bird directs its course, or turns and wheels, but it adds to the superficies of the body

without increasing its weight. In this group the tail is ample, but varies extremely in shape; in some species it is square, in others forked, in some pointed, but in all it is composed of feathers closely resembling those of the wing in texture. Thus is the humming-bird constituted for flight; nor is this extremely rapid merely, but it is capable of long continuance. The flitting progress of the humming-bird from flower to flower resembles that of a bee,—but is infinitely more quick. When, however, the bird is journeying, it sweeps through the air in long undulations, rising and sinking alternately.

It has been supposed by many that the nectar of flowers constitutes the sole food of this charming race, but such is not the fact. Nectar is no doubt a part of their diet, but by no means the whole: they feed on the small insects which lurk in the nectary, or wander over the petals,—nay, they even take insects on the wing, as was observed by Wilson, who also found their fragments in the stomach of such as he examined; and Audubon states, in confirmation, that insects, especially those of the coleopterous order, are the principal food of the humming-bird. The bill, fitted for penetrating into the recesses of flowers, is long and slender, but varies in shape. According to Brisson and others, the tongue consists of two muscular tubes. This organ, which in the humming-bird is mainly instrumental in procuring food, is capable of being protruded to a considerable distance, as we see in the wryneck, woodpecker, &c. Audubon says, that the double-tubed tongue of the humming-bird is covered with a glutinous saliva, so that the insect adheres to it when touched; hence the bird has only to dart its tongue at its prey, and retract it into its mouth.

Diminutive as they are, these beautiful creatures are bold and intrepid, and defend their nests against intruders with the greatest spirit. Their powers of flight give them every advantage in these aërial combats over birds much larger than themselves, at whose eyes they tilt with their sharp-pointed beak, uttering, at the same time, a shrill piercing shriek. Two males seldom meet without a battle: and while the female is sitting her mate attacks indiscriminately every bird that approaches, exhibiting the utmost fury. The nest of the humming-bird varies in different species. We have seen some built on the branch of a tree, others attached to the extreme twigs, so as to wave in the breeze. The materials with which they are constructed are, for the most part, the cotton or down of various plants, beautifully interwoven; some species add an outside layer of moss or lichen. It appears that the number of the eggs laid by the female is usually two, and their colour pure white.

That these beautiful and elegant birds should not be kept in captivity will not surprise those who know the difficulty of preserving them, even in their own regions, for any length of time, in imprisonment. Several attempts have, however, been made; and, on one occasion, two nestlings of a species termed the Mango humming-bird were actually brought alive to England, and lived for a short time in the possession of Lady Hammond; they were very docile, and fed on honey, but we do not know whether insects were offered them or not. Audubon states that he has seen many humming-birds in partial confinement; and that, when fed with honey or syrup exclusively, they soon died in a state of emaciation, but that, when duly supplied with fresh flowers (abounding with insects), and surrounded with gauze-netting, through which insects could enter, they lived in health and were active. Indeed, he mentions an instance in which several were thus kept for the space of twelve months, when they were restored to liberty, the person how attended to them having a long voyage to perform.

To these instances of domestication we may add the following from the 'Habits of Birds,' in the 'Library of Entertaining Knowledge,' where it is quoted from Labat's 'Nouveau Voyage aux Iles de l'Amerique.' "I showed," says this author, "a nest of humming-birds to Father Montdidier, which was placed on a shed near the house. He carried it off with the young when they were about fifteen or twenty days old, and put them in a cage at his room-window, where the parent cock and hen continued to feed them, and grew so tame that they scarcely ever left the room; and though not shut up in the cage or subjected to any restraint, they used to eat and sleep with their brood. I have often seen all the four sitting on Father Montdidier's finger, singing as if they had been perched upon a branch. He fed them with very fine and almost limpid paste, made with biscuit, Spanish wine, and sugar. They dipped their tongue in it, and when their appetite was satisfied, they fluttered and chanted. I never saw anything more lovely than these four pretty little birds, which flew about the house and attended to the call of their foster father. He preserved them in this way five or six months, and we hoped soon to see them breed, when Father Montdidier, having forgotten one night to tie the cage in which they were roosted, by a cord that hung from the ceiling, to keep them from the rats, had the vexation in the morning to find that they had disappeared: they had been devoured."

The family of humming-birds (*Trochilidæ*) is divided into numerous *genera*, having their distinct characters our observations are, of course, general, and apply to the group at large. We may add that upwards of 100 species are known to naturalists.

[Humming-birds, engaged in extracting the nectar, and catching insects, in the flowers of *Bignonia radicans* and *Solandra grandiflora*.]

*** The Office of the Society for the Diffusion of Useful Knowledge is at 59, Lincoln's Inn Fields.

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